CLAIMS

1. An optical scanning probe device for producing an optical tomogram based on reflected light by radiating living body tissue with low-coherence light, comprising:

a flexible sheath in which at least the tip side has excellent light transmittance;

a light exit & entrance portion which is provided in the lumen of the sheath, which has an optical axis intersecting the sheath nearly perpendicularly, and which performs exit and entrance of the light;

a housing for holding the light exit & entrance portion;

a flexible shaft which is joined to the housing and which transfers rotation from a driving unit at the rear end portion; and

a positioning member which is provided on the periphery of the light exit & entrance portion and which adjusts the distance between the living body tissue and the light exit & entrance portion at a predetermined distance larger than the outer radius of the sheath,

wherein the focus position of the light exiting from the light exit & entrance portion can be adjusted in the neighborhood of the predetermined distance by the positioning member.

2. An optical scanning probe device for producing an

optical tomogram based on reflected light by radiating living body tissue with light, comprising:

a flexible sheath in which at least the tip side has excellent light transmittance;

a light exit & entrance portion which is provided in the lumen of the sheath, which has an optical axis intersecting the sheath nearly perpendicularly, and which performs exit and entrance of the light;

a housing for holding the light exit & entrance portion;

a flexible shaft which is coupled to the housing and which transfers rotation from a driving unit at the rear end portion; and

a positioning member which is provided at the sheath tip portion on the side nearer to the tip than is the light exit & entrance portion and which adjusts the distance between the living body tissue and the light exit & entrance portion at a predetermined distance.

3. The optical scanning probe device according to Claim 2, wherein the focal length of light of the light exit & entrance portion is nearly equivalent to the distance between the living body tissue and the light exit & entrance portion adjusted by the positioning member.

4. The optical scanning probe device according to Claim 2, wherein the positioning member is at least one protrusion provided on the outer perimeter surface of the sheath tip

portion in the direction perpendicular to the outer perimeter surface.

5. The optical scanning probe device according to Claim 4, wherein the tip portion of the protrusion is formed from a curved surface.

6. The optical scanning probe device according to Claim 4, wherein the protrusion is formed from an elastic member.

7. The optical scanning probe device according to Claim 4, wherein the protrusion is formed integrally with the elastic member which is provided at the sheath tip and which has a diameter nearly equivalent to that of the sheath.

8. The optical scanning probe device according to Claim 6, comprising a small diameter portion which has a length larger than that of at least the protrusion and which has a diameter smaller than that of the sheath in the direction from the portion of the protrusion in the elastic member toward the rear end portion.

9. The optical scanning probe device according to Claim 6, comprising a connection member for connecting the elastic member and the sheath.

10. The optical scanning probe device according to Claim 9, comprising an elastic member attachment and detachment mechanism which makes the elastic member freely attachable and detachable with respect to the connection member.

11. The optical scanning probe device according to Claim 6,

wherein the protrusion is provided at the rear end of the elastic member.

12. The optical scanning probe device according to Claim 6, wherein the protrusion is provided with a reinforcing member unlikely to be deformed elastically.

13. The optical scanning probe device according to Claim 2, wherein the positioning member comprises a large diameter portion which is provided at the sheath tip portion and which has an outer diameter larger than that of the sheath.

14. An optical scanning probe device for producing an optical tomogram based on reflected light by radiating living body tissue with light, comprising:

a flexible sheath in which at least the tip side has excellent light transmittance;

a light exit & entrance portion which is provided in the lumen of the sheath, which has an optical axis intersecting the sheath nearly perpendicularly, and which performs exit and entrance of the light;

a housing for holding the light exit & entrance portion;

a flexible shaft which is joined to the housing and which transfers rotation from a driving unit at the rear end portion; and

an outer sheath which is provided to cover the sheath and in which the tip side is transparent and is attachable and detachable,

wherein a positioning member which is provided at the outer sheath tip portion on the side nearer to the tip than is the light exit & entrance portion and which adjusts the distance between the living body tissue and the light exit & entrance portion at a predetermined distance is provided.

15. The optical scanning probe device according to Claim 14, wherein the focal length of light of the light exit & entrance portion is nearly equivalent to the distance between the living body tissue and the light exit & entrance portion adjusted by the positioning member.

16. The optical scanning probe device according to Claim 14, wherein the positioning member is at least one protrusion provided on the outer perimeter surface of the outer sheath tip portion in the direction perpendicular to the outer perimeter surface.

17. The optical scanning probe device according to Claim 16, wherein the protrusion is formed integrally with an elastic member which is provided at the outer sheath tip and which has a diameter nearly equivalent to that of the sheath.

18. The optical scanning probe device according to Claim 17, comprising a small diameter portion which has a length larger than that of at least the protrusion and which has a diameter smaller than that of the tip sheath in the direction from the portion of the protrusion in the elastic member toward the rear end portion.

19. The optical scanning probe device according to Claim 14, wherein the positioning member is a balloon provided at the tip of the outer sheath.

20. The optical scanning probe device according to Claim 14, wherein the sheath tip portion is protruded from the outer sheath tip portion, the positioning member is formed from an elastic tube, the elastic tube is formed in order that the inner diameter of the tip made of elastic member is nearly equivalent to the outer diameter of the sheath, the inner diameter of the rear end is nearly equivalent to the outer diameter of the outer sheath, and the intermediate portion has a diameter larger than the outer diameter of the outer sheath, the sheath tip portion is fixed in the tip lumen thereof, and the outer sheath tip portion is fixed in the rear end lumen thereof.

21. The optical scanning probe device according to Claim 20, comprising an outer sheath-movable mechanism capable of changing the relative position of the outer sheath with respect to the sheath in the longitudinal direction.

22. The optical scanning probe device according to Claim 14, wherein the outer sheath tip portion is opened, the positioning member is a metal wire bundle provided at the sheath tip portion, and in the metal wire bundle, the end thereof is fixed to the sheath tip and each metal wire is deformed in order that the outer diameter of the bundle

becomes larger than the outer diameter of the sheath as the tip approaches.

23. The optical scanning probe device according to Claim 22, comprising an outer sheath-movable mechanism capable of changing the relative position of the outer sheath in the longitudinal direction.

24. The optical scanning probe device according to Claim 22, wherein the tip of each metal wire constituting the metal wire bundle is deformed to fold back in the direction of the probe rear end.

25. An optical scanning probe device for producing an optical tomogram based on reflected light by radiating living body tissue with light, comprising:

a flexible sheath in which the tip is closed and at least the tip side has excellent light transmittance;

a flexible shaft which transfers rotation from a driving unit at the rear end portion;

an optical fiber provided in the lumen of the flexible shaft;

a housing connected to the flexible shaft tip;

a condenser lens which is provided in the housing and into which the light exiting from the optical fiber is made to enter;

an optical path change unit for making the light which is made to enter from the condenser lens exit nearly

perpendicularly toward the sheath; and

a focus position-changeable mechanism capable of relatively changing the focus position of the light with respect to the outer perimeter surface of the sheath.

26. The optical scanning probe device according to Claim 25, wherein the focus position-changeable mechanism comprises a fiber-lens interval adjustment mechanism capable of adjusting the interval between the end face of the optical fiber and the condenser lens.

27. The optical scanning probe device according to Claim 25, wherein the focus position-changeable mechanism comprises a lens-optical path change unit interval adjustment mechanism capable of adjusting the interval between the condenser lens and the optical path change unit.

28. The optical scanning probe device according to Claim 25, wherein the focus position-changeable mechanism comprises a lens-exchangeable mechanism capable of exchanging the condenser lens for a condenser lens having a different focal length.

29. The optical scanning probe device according to Claim 25, wherein the focus position-changeable mechanism comprises a thickness distribution in the longitudinal direction, in which the outer diameters of the sheath at least in the neighborhood of the portion facing the optical path change unit are made to have distribution in the longitudinal

direction, and a sheath relative position movement unit capable of changing the relative position relationship between the optical path change unit and the sheath with respect to the longitudinal direction.

30. The optical scanning probe device according to Claim 25, wherein the focus position-changeable mechanism is the one in which, regarding at least the surface facing the optical path change unit, the thickness of the sheath is made to have a thickness distribution in the circumferential direction.

31. A positioning unit provided at the tip of an endoscope used together with an optical scanning probe which is inserted through a forceps channel of the endoscope and which includes an exit portion for making scanning light exit in order to produce a tomogram of a test part,

comprising a scanning light passage hole for passing the scanning light exiting from the exit portion to the position corresponding to the exit portion of the optical scanning probe when the optical scanning probe is protruded by a predetermined amount from the tip of the endoscope in the longitudinal direction of the endoscope.

32. The positioning unit according to Claim 31, comprising a fitting portion which can be fitted to the endoscope while being freely attachable and detachable.

33. The positioning unit according to Claim 32, comprising

a phasing mechanism which determines positional relationship regarding the fitting to the endoscope.

34. The positioning unit according to Claim 31, wherein a light beam exiting from the optical scanning probe and the test part intersect at a predetermined angle, and the exit portion and the light transmission hole are kept at a predetermined interval.

35. The positioning unit according to Claim 34, wherein the predetermined angle is a nearly right angle.

36. The positioning unit according to Claim 34, wherein the predetermined interval is smaller than the interval between the exit portion and the focus position of the light beam.

37. The positioning unit according to Claim 34, wherein the predetermined interval is nearly equivalent to the interval between the exit portion and the focus position of the light beam.

38. The positioning unit according to Claim 34, wherein the predetermined interval is larger than the interval between the exit portion and the focus position of the light beam.

39. The positioning unit according to Claim 34, wherein the positioning unit is described in an additional item 1, the endoscope comprises the first channel for inserting the optical scanning probe and the second channel for inserting an endo-therapy product, and the tip opening of the second channel is located on the extended line of the scanning

position of the light beam.

40. The positioning unit according to Claim 34, wherein the positioning unit comprises a hollow hood in order to protrude the optical scanning probe in the lumen thereof, and the light transmission hole is composed of a side surface hole opened at the side surface of the hood in the longitudinal axis direction.

41. The positioning unit according to Claim 40, comprising a side surface therapy unit for performing therapy of a test part in contact with the side surface hole in the neighborhood of the side surface hole.

42. The positioning unit according to Claim 40, comprising a marking unit for applying a landmark to a test part in contact with the side surface hole in the neighborhood of the side surface hole.

43. The positioning unit according to Claim 39, wherein the positioning unit comprises a hollow hood in order to protrude the optical scanning probe in the lumen thereof, and the light transmission hole is composed of a side surface hole opened at the side surface of the hood in the longitudinal axis direction.

44. The positioning unit according to Claim 43, comprising a side surface therapy unit for performing therapy of a test part in contact with the side surface hole in the neighborhood of the side surface hole.

45. The positioning unit according to Claim 43, comprising a marking unit for applying a landmark to a test part in contact with the side surface hole in the neighborhood of the side surface hole.

46. The positioning unit according to Claim 34, wherein the positioning unit comprises a hollow hood in order to protrude the optical scanning probe in the lumen thereof, and the light transmission hole includes an inclined tip opening portion provided at the tip of the hood in order that the light beam exits from the hood tip toward the test specimen.

47. The positioning unit according to Claim 46, comprising a marking unit for applying a landmark to a test part in contact with the tip opening portion in the tip opening portion.

48. The positioning unit according to Claim 39, wherein the positioning unit comprises a hollow hood in order to protrude the optical scanning probe in the lumen thereof, and the light transmission hole includes an inclined tip opening portion provided at the tip of the hood in order that the light beam exits from the hood tip toward the test specimen.

49. The positioning unit according to Claim 48, comprising a marking unit for applying a landmark to a test part in contact with the tip opening portion in the tip opening

portion.

50. The positioning unit according to Claim 40, further comprising a protrusion amount control member for controlling the protrusion amount of the optical scanning probe from the tip of the endoscope.

51. The positioning unit according to Claim 50, wherein the protrusion amount control member is integrally provided at the hood tip, and is a locking part formed in order to block at least protrusion of the probe at the tip side.

52. The positioning unit according to Claim 43, further comprising a protrusion amount control member for controlling the protrusion amount of the optical scanning probe from the tip of the endoscope.

53. The positioning unit according to Claim 52, wherein the protrusion amount control member is integrally provided at the hood tip, and is a locking part formed in order to block at least protrusion of the probe at the tip side.

54. The positioning unit according to Claim 46, further comprising a protrusion amount control member for controlling the protrusion amount of the optical scanning probe from the tip of the endoscope.

55. The positioning unit according to Claim 54, wherein the protrusion amount control member is integrally provided at the hood tip, and is a locking part formed in order to block at least protrusion of the probe at the tip side.

56. The positioning unit according to Claim 48, further comprising a protrusion amount control member for controlling the protrusion amount of the optical scanning probe from the tip of the endoscope.

57. The positioning unit according to Claim 56, wherein the protrusion amount control member is integrally provided at the hood tip, and is a locking part formed in order to block at least protrusion of the probe at the tip side.

58. The positioning unit according to Claim 40, further comprising a movement control member for controlling movement of the exit portion of the optical scanning probe in the direction nearly perpendicular to the axis center of the endoscope when the axis center of the optical scanning probe and the axis center of the endoscope are arranged in parallel with each other.

59. The positioning unit according to Claim 58, wherein the movement control member comprises a protrusion portion integrally provided inside the hood tip in order to protrude in the neighborhood of the axis center of the optical scanning probe, and a guide groove which is formed on the protrusion portion in the longitudinal axis direction of the hood and which is engraved centering the axis center of the optical scanning probe to have the same diameter as that of the optical scanning probe.

60. The positioning unit according to Claim 43, further

comprising a movement control member for controlling movement of the exit portion of the optical scanning probe in the direction nearly perpendicular to the axis center of the endoscope when the axis center of the optical scanning probe and the axis center of the endoscope are arranged in parallel with each other.

61. The positioning unit according to Claim 60, wherein the movement control member comprises a protrusion portion integrally provided inside the hood tip in order to protrude in the neighborhood of the axis center of the optical scanning probe, and a guide groove which is formed on the protrusion portion in the longitudinal axis direction of the hood and which is engraved centering the axis center of the optical scanning probe to have the same diameter as that of the optical scanning probe.

62. The positioning unit according to Claim 40, wherein a channel, through which the optical scanning probe can be inserted, is provided in the hood.

63. The positioning unit according to Claim 43, wherein a channel, through which the optical scanning probe can be inserted, is provided in the hood.

64. The positioning unit according to Claim 46, further comprising a movement control member for controlling movement of the exit portion of the optical scanning probe in the direction nearly perpendicular to the axis center of

the endoscope when the axis center of the optical scanning probe and the axis center of the endoscope are arranged in parallel with each other.

65. The positioning unit according to Claim 64, wherein the movement control member comprises a protrusion portion integrally provided inside the hood tip in order to protrude in the neighborhood of the axis center of the optical scanning probe, and a guide groove which is formed on the protrusion portion in the longitudinal axis direction of the hood and which is engraved centering the axis center of the optical scanning probe to have the same diameter as that of the optical scanning probe.

66. The positioning unit according to Claim 48, further comprising a movement control member for controlling movement of the exit portion of the optical scanning probe in the direction nearly perpendicular to the axis center of the endoscope when the axis center of the optical scanning probe and the axis center of the endoscope are arranged in parallel with each other.

67. The positioning unit according to Claim 66, wherein the movement control member comprises a protrusion portion integrally provided inside the hood tip in order to protrude in the neighborhood of the axis center of the optical scanning probe, and a guide groove which is formed on the protrusion portion in the longitudinal axis direction of the

hood and which is engraved centering the axis center of the optical scanning probe to have the same diameter as that of the optical scanning probe.

68. The positioning unit according to Claim 50, wherein the protrusion amount control member and the movement control member are integrally provided at the hood tip, and comprise a locking part formed in order to block at least protrusion of the optical scanning probe at the tip side and a hole not penetrated, which is formed coaxially with the axis center of the optical scanning probe of the locking part from the rear end side of the hood and which has a diameter nearly equivalent to that of the optical scanning probe.

69. The positioning unit according to Claim 52, wherein the protrusion amount control member and the movement control member are integrally provided at the hood tip, and comprise a locking part formed in order to block at least protrusion of the optical scanning probe at the tip side and a hole not penetrated, which is formed coaxially with the axis center of the optical scanning probe of the locking part from the rear end side of the hood and which has a diameter nearly equivalent to that of the optical scanning probe.

70. The positioning unit according to Claim 58, wherein the protrusion amount control member and the movement control member are integrally provided at the hood tip, and comprise a locking part formed in order to block at least protrusion

of the optical scanning probe at the tip side and a hole not penetrated, which is formed coaxially with the axis center of the optical scanning probe of the locking part from the rear end side of the hood and which has a diameter nearly equivalent to that of the optical scanning probe.

71. The positioning unit according to Claim 60, wherein the protrusion amount control member and the movement control member are integrally provided at the hood tip, and comprise a locking part formed in order to block at least protrusion of the optical scanning probe at the tip side and a hole not penetrated, which is formed coaxially with the axis center of the optical scanning probe of the locking part from the rear end side of the hood and which has a diameter nearly equivalent to that of the optical scanning probe.

72. The positioning unit according to Claim 40, further comprising a part in the visual field located in an observation field of view of the endoscope when fitted at the tip of the endoscope, and a marking unit which is provided at a predetermined position of the part in the visual field and which indicates the scanning position of the scanning light by the optical scanning probe.

73. The positioning unit according to Claim 43, further comprising a part in the visual field located in an observation field of view of the endoscope when fitted at the tip of the endoscope, and a marking unit which is

provided at a predetermined position of the part in the visual field and which indicates the scanning position of the scanning light by the optical scanning probe.

74. The positioning unit according to Claim 46, further comprising a part in the visual field located in an observation field of view of the endoscope when fitted at the tip of the endoscope, and a marking unit which is provided at a predetermined position of the part in the visual field and which indicates the scanning position of the scanning light by the optical scanning probe.

75. The positioning unit according to Claim 48, further comprising a part in the visual field located in an observation field of view of the endoscope when fitted at the tip of the endoscope, and a marking unit which is provided at a predetermined position of the part in the visual field and which indicates the scanning position of the scanning light by the optical scanning probe.

76. An endoscope device comprising an optical scanning probe which is inserted through a forceps channel of an endoscope and which includes an exit portion for making scanning light exit in order to produce a tomogram of a test part and a positioning unit provided at the tip of the endoscope,

wherein marking which indicates the scanning position of the scanning light by the optical scanning probe in

displayed field of view of the endoscope is provided.

77. The endoscope device according to Claim 76, wherein marking which indicates the position of the positioning unit located in an observation view of the endoscope in displayed field of view of the endoscope is provided.

78. An optical scanning probe device comprising:

an optical scanning probe which is inserted through a forceps channel of an endoscope and which includes an exit portion for making scanning light exit in order to produce a tomogram of a test part based on low coherence interference; and

a positioning unit which is provided at the tip of the endoscope and which includes a scanning light passage hole for passing the scanning light exiting from the exit portion to the position corresponding to the exit portion of the optical scanning probe when the optical scanning probe is protruded by a predetermined amount from the tip of the endoscope in the longitudinal direction of the endoscope.